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10/734,999	12/12/2003	Eugene Marsh	MI22-2461	1993

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EXAMINER	
DUONG, KHANH B	

ART UNIT	PAPER NUMBER
2822	

DATE MAILED: 08/08/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/734,999	MARSH ET AL.	
	Examiner	Art Unit	
	Khanh B. Duong	2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 May 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *38-82* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *52-70,72,73 and 75-82* is/are allowed.

6)☒ Claim(s) *38-51,71 and 74* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *5/10/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

This Office Action is in response to the amendment filed May 25, 2005.

Accordingly, claims 46-51 and 77 were amended

Currently, claims 38-82 remain pending.

Terminal Disclaimer

The terminal disclaimer filed on May 25, 2005 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of U.S. Patent No. 6,673,701 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 38-43, 49, 50, 71 and 74 are rejected under 35 U.S.C. 102(b) as being anticipated by Kim et al. (U.S. Patent No. 6,270,572).

Re claims 38 and 39, Kim et al. ("Kim") discloses in FIGs. 10 and 11 an atomic layer deposition method comprising: positioning a semiconductor substrate 4 within a deposition chamber 30; flowing a first precursor gas (first reactant) within the deposition chamber 30 to form a first monolayer on the substrate 4, said first precursor gas flowing comprising a plurality (two) of first precursor gas pulses (steps 105 & 115), at least two of the plurality of first precursor gas pulses separated by a period of time when no gas is fed to the chamber 30 (step

110) [see col. 5, line 21-24]; after forming the first monolayer on the substrate 4, flowing a second precursor gas (second reactant, step 135) different in composition from the first precursor gas within the deposition chamber 30 to form a second monolayer on the first monolayer; and flowing multiple time-spaced inert purge gas pulses (steps 120 & 130) within the deposition chamber 30 intermediate the flowing of the first precursor gas (steps 105 & 115) and the second precursor gas (step 135).

Re claim 40, since Kim expressly discloses FIG. 11 being a continuous feed-back process (step 105 to 145), the plurality of first precursor gas pulses can be more than two (steps 105, 115 & 105 again).

Re claim 41, since Kim discloses the ALD process of FIG. 11 being a continuous feed-back process (step 105 to 145), such process comprises flowing at least one inert purge gas pulse (step 140) to the substrate within the chamber 30 immediately prior to the first precursor flowing (step 105).

Re claims 42 and 43, Kim discloses the first precursor comprises $TiCl_4$ and the second precursor comprises NH_3 or vice versa [see col. 6, line 38-40].

Re claims 49 and 50, Kim discloses the two first precursor gas pulses may be equal in time or unequal in time [see col. 5, line 27-30].

Re claim 71, Kim expressly discloses in FIG. 9A the second monolayer B is formed over an area of the substrate 1, the second monolayer B being continuously formed over the area [see col. 4, lines 38-45].

Re claim 74, see discussion above regarding claims 38 and 39.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 44 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim in view of Werkhoven et al. (U.S. Patent No. 6,534,395).

Re claims 44 and 45, Kim discloses using precursors of trimethylaluminum (TMA) and water, instead of TMA and ozone, to form Al_2O_3.

Werkhoven et al. ("Werkhoven") suggests an ALD process that comprises using precursors of TMA and ozone to form Al_2O_3 [see col. 14, line 30-34 & col. 15, line 1-3].

Since Kim and Werkhoven are from the same field of endeavor, the purpose disclosed by Werkhoven would have been recognized in the pertinent prior art of Kim.

Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the method disclosed by Kim by using ozone as a precursor for forming Al_2O_3 as suggested by Werkhoven, since Werkhoven states at column 15, line 1-3 that ozone is an alternative for water.

Claims 46-48 and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim.

Re claims 46-48 and 51, Kim fails to specifically disclose the period of time when no gas is fed to the chamber being less than, equal to or greater than the time of gas flow of each or both of the two first precursor gas pulses.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to optimize and select an appropriate duration for the period of time when no gas is fed to the chamber relative to the time of gas flow of the two first precursor gas pulses. The selection of parameters such as energy, power, concentration, temperature, time, depth, thickness, etc., would have been obvious and involve routine optimization which has been held to be within the level of ordinary skill in the art. "Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may be impart patentability to a process if the particular ranges claimed produce new and unexpected result which is different in kind and not

merely degree from results of prior art ... such ranges are termed 'critical ranges' and the applicant has the burden of proving such criticality ... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation". *In re Aller*, 105 USPQ 233, 235 (CCPA 1955). See also MPEP 2144.05.

Allowable Subject Matter

Claims 52-70, 72, 73 and 75-82 are allowed.

The following is a statement of reasons for the indication of allowable subject matter: none of the prior art of record, taken alone or in combination, fairly shows or suggests all the process limitations as claimed.

Re claim 52, none of the prior art of record discloses a deposition method comprising: after forming the first monolayer on the substrate, flowing a second precursor gas different in composition from the first precursor gas within the deposition chamber to form a second monolayer on the first monolayer, said second precursor gas flowing comprising a plurality of time spaced second precursor gas pulses; and after forming the second monolayer on the substrate, flowing a third precursor gas different in composition from the second precursor gas within the deposition chamber to form a third monolayer on the substrate, the third precursor being different in composition from the first precursor.

Re claim 63, none of the prior art of record discloses a deposition method comprising: after forming the first monolayer on the substrate, flowing a second precursor gas different in composition from the first precursor gas within the deposition chamber to form a second monolayer on the first monolayer, said second precursor gas flowing comprising at least two

time abutting second precursor gas pulses which are characterized by different flow rates of the second precursor; and after forming the second monolayer on the substrate, flowing a third precursor gas different in composition from the second precursor gas within the deposition chamber effective to form a third monolayer on the substrate.

Re claim 75, none of the prior art of record discloses an atomic layer deposition method comprising: after forming the first layer on the substrate, flowing a second precursor gas different in composition from the first precursor gas to proximate the substrate within the deposition chamber to form a second layer on the first layer, said second precursor gas flowing comprising a plurality of time spaced second precursor gas pulses; and after forming the second layer on the substrate, flowing a third precursor gas different in composition from the second precursor gas to proximate the substrate within the deposition chamber to form a third layer on the substrate, the third precursor gas being different in composition from the first precursor gas.

Re claim 76, none of the prior art of record discloses an atomic layer deposition method comprising: after forming the first Layer on the substrate, flowing a second precursor gas different in composition from the first precursor gas to proximate the substrate within the deposition chamber to form a second layer on the first Layer, said second precursor gas flowing comprising at least two time abutting second precursor gas pulses which are characterized by different flow rates of the second precursor; and after forming the second Layer on the substrate, flowing a third precursor gas different in composition from the second precursor gas to proximate the substrate within the deposition chamber effective to form a third Layer on the substrate.

Re claim 77, none of the prior art of record discloses a deposition method comprising: after forming the first monolayer on the substrate, flowing a second precursor gas different in composition from the first precursor gas within the deposition chamber to form a second monolayer on the first monolayer, said second precursor gas flowing comprising a volumetric gas flow rate which varies across a duration of second precursor gas flowing within the deposition chamber; and after forming the second monolayer on the substrate, flowing a third precursor gas different in composition from the second precursor gas within the deposition chamber effective to form a third monolayer on the substrate.

Response to Arguments

Applicant's arguments filed May 25, 2005 with regard to the rejections of claims 38 and 74 under Kim have been fully considered but they are not persuasive.

Applicant argues that Kim fails to disclose flowing multiple time spaced inert purge gas pulses within the deposition chamber intermediate the flowing of the first precursor gas and the second precursor gas. In response, the Examiner respectfully disagrees because, as previously discussed above, Kim expressly discloses in FIG. 11 flowing multiple time spaced inert purge gas pulses (steps 120 & 130) within the deposition chamber intermediate the flowing of the first precursor gas (step 115) and the second precursor gas (step 135).

Applicant further argues that "[t]he Patent Office's rejection of claims 38 and 74 over Kim et al. in this application is believed to be inconsistent with the allowance of amended claim 1 in the parent application". In response, the Examiner has no comment regarding the prosecution of the parent application.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khanh B. Duong whose telephone number is (571) 272-1836. The examiner can normally be reached on 10:00-6:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KBD

Michael Trinh
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Act SPE